Manifestation of respiratory functions of hockey players under training impacts of different directions

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Abstract

Objective of the study was to identify the features of the reaction of the respiratory system of hockey players to a special physical load.

Methods and structure of the study. The survey involved 25 qualified hockey players of various types of energy metabolism at the age of 16-18 years. On the basis of indicators of the response of the respiratory system of athletes to loads of varying intensity, additional reserves for increasing fitness were studied.

Results and conclusions. The gradation of the reactivity of the respiratory system of hockey players, depending on the parametric algorithmization of the load, makes it possible to stimulate the deployment of additional reserves to increase fitness. Variation of non-specific load parameters is expedient in order to activate recovery based on a combination of aerobic and anaerobic mechanisms of energy metabolism of qualified hockey players.

Keywords: *respiratory functions, hockey players, metabolism, load intensity.*

Introduction. The impact of the training load on the activation of physiological functions is manifested in the mobilization of the adaptive reserves of the body of athletes [1, 3]. An increase in the level of fitness is accompanied by an increase in reserve capabilities and the effectiveness of their implementation in the main sports result. The basis for improving adaptive mechanisms is the activation of metabolic processes in the body of hockey players in the annual cycle of sports training [2].

The growth of sports results is ensured not only by an increase in the ability to tolerate physical activity, but also by the ability to quickly and fully restore body functions reduced under the influence of sports training [7].

Optimal planning and implementation of the systemic use of special training means activates the processes of working capacity recovery after completing the volume of training work [5].

The training process control function ensures the achievement of planned indicators during sports training and thus ensures the achievement of the required sports result in hockey [4]. An informative indicator of adaptive shifts on the physiological contour of the training process regulation is the features of the individual reaction of the respiratory system of athletes to the experienced training load [6].

Objective of the study was to identify the features of the reaction of the respiratory system of hockey players to a special physical load.

Methods and structure of the study. In order to improve the methods of managing the training of hockey players of various sports specialization, a study was made of the characteristics of the reaction of the respiratory system of athletes to a special physical load. Physiological monitoring parameters were recorded in 25 qualified athletes aged 16-18 years. The study involved hockey players with an aerobic type of energy metabolism (7 people), an anaerobic type of energy metabolism (8 people), a mixed type of energy metabolism (8 people).

The main part of the training sessions was differentiated by the focus on increasing anaerobic power, aerobic-anaerobic productivity, aerobic work support mechanisms. Testing was carried out on replicators of special training in hockey.

At the first stage, exercises aimed at increasing the anaerobic power of work were used. The task consisted of four series of six segments of 15 m of skating at maximum speed. Rest after each segment was carried out until the pulse was restored to 120 beats/min, the rest between series was 5 minutes.

At the second stage, the indicators of the reaction of the respiratory system of hockey players to the load in the aerobic-anaerobic zone were studied. To do this, the task was performed in skating four segments of 200 m each. 30 seconds were allotted for rest between segments.

At the third stage, research was carried out on the reactivity of hockey players to polarized training in an aerobic mode at the level of maximum oxygen consumption (MOC). The effects of aerobic metabolism were achieved by an exercise in moving 3000 meters while dribbling the puck.

The study of the functions of the respiratory system of hockey players was carried out using a spirometer (spirograph) Spirolab-3.

The three most informative spirometric markers were measured: lung capacity (VC); forced vital capacity (FVC); forced expiratory volume in the interval of the first second (FEV1).

To measure FVC, before the test, several even breathing movements were performed, then a slow deep breath, and then a full exhalation. This was followed by the informative part of the test - the fastest and deepest breath.

When measuring the volume of intensively exhaled air in the first second, the subject performed several active breathing cycles at a rate of 30 breaths and exhalations per minute.

Results of the study and their discussion. Table 1 shows the indicators of the reactivity of the respiratory function of hockey players under the influence of physical activity in the anaerobic mode of training.

The results obtained indicate that the respiratory system of athletes reacts differently to physical activity, depending on the predominant type of metabolism of hockey players.

Table 1. *Dynamics of indicators of respiratory functions during training for the development of anaerobic performance of hockey players,* $\bar{x} \pm m$ *(l)*

Dominant type of metabolism	Indicator	Before load	After load	Growth, %
Anaerobic	VC	4,78±0,6	5,04±0,4	5,43
	FVC	4,81±0,2	4,83±0,5	0,41
	FEV1	3,66±0,5	4,51±0,6	25,27
Mixed	VC	4,87±0,4	5,05±0,7	3,69
	FVC	4,81±0,7	4,83±0,2	0,41
	FEV1	3,91±0,6	4,13±0,5	5,62
Aerobic	VC	5,25±0,7	4,71±0,3	-10,28
	FVC	5,13±0,1	5,00±0,8	-2,53
	FEV1	4,76±0,4	4,59±0,8	-3,70

Table 2. *Dynamics of indicators of respiratory functions of hockey players during aerobic-anaerobic training,* $\bar{x} \pm m$ *(l)*

Dominant type of metabolism	Indicator	Before load	After load	Growth, %
Anaerobic	VC	4,45±0,4	4,87±0,2	9,43
	FVC	4,54±0,2	4,86±0,5	7,04
	FEV1	3,95±0,3	4,49±0,1	13,61
Mixed	VC	4,24±0,1	4,52±0,6	6,60
	FVC	4,61±0,7	4,74±0,8	2,80
	FEV1	3,91±0,4	4,13±0,7	5,62
Aerobic	VC	4,87±0,2	5,05±0,6	3,69
	FVC	4,01±0,8	4,11±0,7	2,49
	FEV1	4,11±0,1	4,23±0,2	3,17

Table 3. *Dynamics of indicators of respiratory functions of hockey players during training for the development of basic endurance, $\bar{x}$ ±m (l)*

Dominant type of metabolism	Indicator	Before load	After load	Growth, %
Anaerobic	VC	2,84±0,02	3,41±0,10	20,07
	FVC	3,96±0,06	4,14±0,11	15,0
	FEV1	3,6±0,05	3,79±0,06	5,27
Mixed	VC	4,71±0,06	4,85±0,04	3,11
	FVC	5,57±0,09	5,77±0,02	5,26
	FEV1	4,09±0,12	4,78±0,05	18,78
Aerobic	VC	4,79±0,08	4,95±0,06	3,34
	FVC	5,47±0,06	5,78±0,07	5,66
	FEV1	4,04±0,07	4,88±0,02	20,79

It was found that the work performed in the anaerobic mode causes a different reaction of the body of hockey players of different types of energy metabolism. Hockey players of the 1st group showed the highest increase in forced expiratory volume in the interval of the first second (FEV1) - 25.27%. The increase in the FEV1 indicators of hockey players of the 2nd group for physical activity was 5.62%. Hockey players of the 3rd group showed a decrease in the FEV1 by 3.70%.

The reaction of the respiratory system of hockey players of the 2nd and 3rd groups turned out to be significantly less compared to the results of the athletes of the 1st group. Anaerobic algorithmization of loads causes greater reactivity of hockey players with an anaerobic type of metabolism in the utilization of air oxygen in the first seconds of work (Table 2).

The reactivity of the respiratory functions of athletes in the aerobic-anaerobic regime ensured the deployment of functional reserves in all experimental groups.

Hockey players of the 1st group have a higher reaction to the load than athletes of the 2nd and 3rd groups. There is an optimal activation of the respiratory function of the body of hockey players.

In table 3 shows changes in the indicators of the respiratory functions of hockey players under the influence of training on the development of basic endurance.

The impact of aerobic load volumes leads to a positive reactivity of the respiratory functions of hockey players related to all types of energy metabolism. Hockey players of all experimental groups recorded a significant increase in the FEV1. It was revealed that the respiratory system of hockey players with a predominance of aerobic and mixed types of metabolism reacts intensively to physical activity in the aerobic zone at the level of the MOC. Hockey players with a predominance of the aerobic type of metabolism have more powerful oxidative mobilization resources. With an increase in the duration of work, hockey players of anaerobic and mixed types form a high oxygen debt, which leads to pronounced fatigue. This indicates insufficient fitness when performing work with an aerobic orientation of training. Indicators of respiratory functions indicate the need to perform the amount of work in the zone of high power for 30-40 minutes. Due to the increase in the intensity of the work of the cardiorespiratory system of hockey players, the percentage of MOC and the saturation of blood hemoglobin with oxygen increases to a physiological maximum.

Conclusions. The gradation of the reactivity of the respiratory system of hockey players, depending on the parametric algorithmization of the load, makes it possible to stimulate the deployment of additional reserves to increase fitness. The use of aerobic load mobilization stimuli in the training process will improve the functioning of the aerobic capabilities of the energy metabolism of hockey players with a predominance of anaerobic and aerobic types of metabolism.

Variation of non-specific load parameters is expedient in order to activate recovery based on a combination of aerobic and anaerobic mechanisms of energy metabolism of qualified hockey players.

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